SANDIA CORPORATION

PRIME CONTRACTOR TO THE ATOMIC ENERGY COMMISSION

ALBUQUERQUE, NEW MEXICO • LIVERMORE, CALIFORNIA

LAB NEWS

VOL. 18, NO. 13, JULY 1, 1966

Unique Ram Air Inflated Bag Used in New Rocket Payload Recovery System

Seven successful recoveries of rocket payloads dropped in the ocean off Barking Sands in Hawaii have proved a new recovery system and flotation bag design developed by Don W. Johnson of Rocket and Recovery Systems Division 9324.

The new recovery system uses a ram-air filled flotation bag, called FARA (Flotation Apparatus Ram Air), which rides on top of a six-foot guide surface parachute. The bag is inflated by the air stream through the parachute. A second flotation bag is inflated from a bottle of compressed carbon dioxide (CO_2). Either the ram air bag or the CO_2 bag will support the 150-pound rocket payloads.

The recovery system was designed for use with the Nitehawk series of Sandia sounding rockets which are used for upper air research and atmospheric sampling.

In any water-impact recovery system, the flotation gear is the most critical component. CO_2-filled flotation bags can be punctured and, unless the payload is buoyant, it is lost. In the past, it has been impossible to provide a backup system with two CO_2-filled bags because the bottles, valves, and plumbing are bulky and cannot be packed in the limited space available in the rocket payload.

The FARA adds nothing but the material of the bag to the recovery system. The complete dual system weighs 14 pounds, can be packed in a cylinder 7-⅞ inches in diameter and 15 inches long. Components of the recovery system include a three-foot drag parachute, the FARA bag, the CO_2 bottle, valves, bag, a six-foot guide surface parachute, and the locator beacon and antenna.

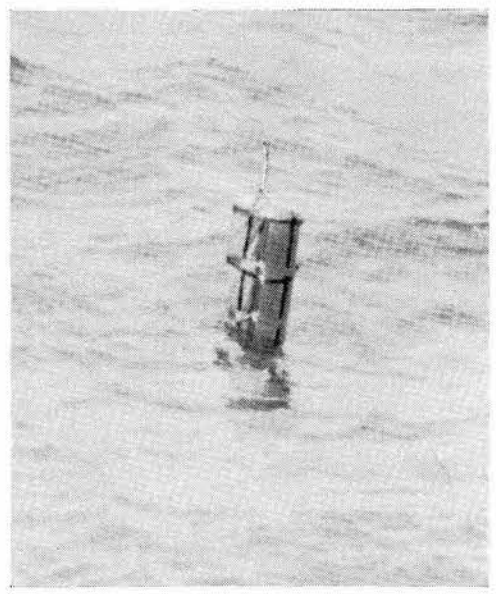
When inflated, the bags are 54 inches long and float vertically holding the beacon antenna well out of the water. The tiny two-ounce transmitter, developed by J. E. Hinde (9231), L. M. Stone and A. A. Young (both 9221), broadcasts a signal which can be picked up by shore-based equipment 96 nautical miles away. The unique antenna is made from a steel measuring tape, the kind carpenters carry around in their pocket. Five strips of the tape are riveted together to form a highly flexible but strong antenna. The flexibility enables it to be packed in the small space available.

MARINE HELICOPTER fishes a Nitehawk rocket payload out of the ocean near Barking Sands Launch Site in Hawaii. The payload was easily located from the signal produced by the tiny two-ounce transmitter in the Sandia-designed recovery system.

The FARA concept was patented by I. T. Holt and H. E. Widdows (both 9324) in December 1964. Don Johnson adapted the concept for the new recovery system.

Key features include use of a guide surface parachute with a cone at the top which forces air into the FARA bag. The original invention called for a small stabilizing parachute attached to the top of the FARA bag. Careful design of the FARA in connection with the CO_2 bag eliminated the need for this parachute.

J. H. Von Dreele and J. R. Simpson (both 1324) contributed the improved CO_2 valve to the development of the recovery system. W. C. Womack (9224) was responsible for the mechanical design of the Nitehawk payload.



DUAL BAGS with transmitter and antenna float high in the water. Either the ram air bag or the CO_2-inflated bag is capable of supporting the 150-pound rocket payload, which hangs under the surface.

JTF-2 Flight Test Program Starts In Arkansas; 50 Sandians in Field

Last Monday, Air Force F-4C Phantoms and Navy A-6 Intruders began roaring at low level over a test range in portions of Arkansas, Louisiana, and Oklahoma. They carry Sandia-designed instrumentation pods which in conjunction with instruments on board high flying C-130 transport aircraft, measure and record complete flight profiles and test events.

The main phase of the Joint Task Force-Two test 4.1 is now underway and will continue through September. Aircraft will fly from 4 to 15 flights daily, departing from a point near England AFB in Louisiana and navigating at low altitude in nine-mile-wide corridors to simulated targets centered in the test area around Mena, Ark.

About 50 Sandians of Systems Evaluation Department 9210 are now in the field supporting the operation. Sandia provides technical and scientific assistance to the JTF-2 mission. Purpose of the tests is to gather statistically valid data for evaluation of low level penetration techniques. The information will also be useful in planning future aircraft and anti-aircraft needs of the military services.

An important part of the data collection activity will be the information gathered by members of Sandia's Personnel organization who will interview the test pilots in debriefing sessions after each mission. Directed by A. D. Swain and G. C. Shelton, human factors specialists of Systems Reliability Division 2152, the interview program will be valuable in the interpretation of data gathered by the instrumentation pods.

The human factors specialists helped design the flight tests from a human capability viewpoint, and assisted in writing the questionnaires which test pilots will complete after each flight. Twenty-three Personnel organization interviewers, under the leadership of B. H. Finley (3113), will alternate the assignment at England AFB. Although experienced in interview techniques, the interviewers received additional indoctrination by the human factors specialists for the JTF-2 assignments.

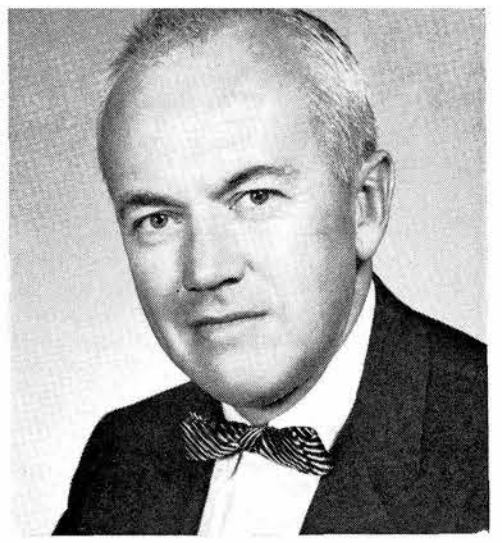
As tests progress, other aircraft and crews from operational units of the military will fly the test course. Each crew will receive a mission briefing, navigate to the test area, locate targets, and simulate an attack. No ordnance will be carried nor will any aerial drops be made. All aircraft will fly at subsonic speeds.

Part of the tests will measure the reaction time of ground defense crews to the attacking aircraft. An observer response box, designed by Sandia, will record the reaction times.

Now under development by Department 9210 is a flight test simulator, using a spherical screen, which will create the illusion of flying at low levels to a target. The simulator will extend data on pilot/aircraft performance.

J. J. Miller, supervisor of Test Operations and Facilities Division 9214, is the Sandia field test director for JTF-2 operations.

F-4 PHANTOM, the Air Force's fastest and highest flying fighter-bomber now in operational use, is one type of aircraft participating in the current JTF-2 flight tests in Arkansas. It is a two-engine, two-man, all-weather weapon system now being used in Southeast Asia.



Eaton H. Draper

Eaton H. Draper, a Sandia vice president for five years, died unexpectedly at a local hospital June 24. He was 48.

Sandia President S. P. Schwartz said, "I find it very difficult to express my feelings on this sudden loss to Eaton's family and to his many friends.

"Eaton gave of himself to all of us and we truly will miss him. His contributions to Sandia and to all the organizations with whom he has served were outstanding. We will remember him with pride."

Mr. Draper had been at Sandia since September 1948. He was appointed division supervisor in 1949 and became a department manager a year later. In 1957 he was named director of systems development and three and a half years later he was elected vice president, development. Mr. Draper assumed his position as vice president, 2000, on Jan. 1, 1965.

He was graduated from the University of Colorado in 1940 with a BS degree in mechanical engineering and took graduate work at Stevens Institute of Technology for three years while employed as assistant project engineer at Wright Aeronautical Corporation, Wood-Ridge, N.J., from 1940-47.

Mr. Draper also worked a year for AVCO Manufacturing Corporation, Lycoming Division, in Stratford, Conn., as engineering manager.

His professional activities included memberships in the American Society of Mechanical Engineers and the American Society for Quality Control, and past service as vice president of ASME's Region VIII. Always interested in civic activities, he was appointed last February to the Albuquerque Zoological Advisory Board and served as vice chairman, was a member of the Girl Scout Steering Committee, and was committee chairman of Boy Scout Troop 841.

He is survived by his wife, Elizabeth; two sons, John and Charles; a daughter, Frances; and a sister, Mrs. John Zuck.

G. W. Gobeli Transfers To Sandia from BTL

Garth W. Gobeli has transferred from Bell Telephone Laboratories to head the newly-created Transient Effects in Devices Division 5214, in Radiation Physics Department, effective July 1.

During the summer of 1964 he was on loan to Sandia for a few months to carry out research in Crystal Lattice Defects Division 5211.

He has a BS degree from Rice University, an MS from the University of Illinois, and a PhD degree from Purdue University, all in physics. Mr. Gobeli is a fellow of the American Physical Society.

Editorial Comment

"We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of Happiness. That to secure these rights, Governments are instituted among Men, deriving their just powers from the consent of the governed. That whenever any Form of Government becomes destructive to these ends, it is the Right of the People to alter or to abolish it, and to institute new Government, laying its foundation on such principles and organizing its powers in such form, as to them shall seem most likely to effect their Safety and Happiness."

—from the Declaration of Independence

On July 4, 1776, the Continental Congress adopted the Declaration of Independence, pledging to support it with their lives ,their fortunes, and their sacred honor.

In the 19 decades that followed, Americans have fought and died for "Rights" expressed in the Declaration and for the freedoms assured by our Constitution. And our government still strives to protect these rights and freedoms and to extend them throughout our citizenry.

In observing the anniversary of the Declaration of Independence, we might well consider ourselves fortunate to be living in a country which still recognizes that the blessings of life, liberty, and the pursuit of happiness are valid goals for mankind.

CERTIFICATES IN DATA PROCESSING were recently awarded (l to r) T. M. Keegan (9427), A. J. Arenholz (9421), and R. D. Rowley (9421).

Three Earn Data Processing Award

Three Sandians were among 408 persons in the country who passed the 1966 examination for the Certificate in Data Processing. They are T. M. Keegan (9427), A. J. Arenholz (9421), and R. D. Rowley (9421).

The certificates are awarded by the Data Processing Management Association.

The three-hour examination is designed to test a wide area of data processing knowledge considered by DPMA to be mandatory for professional competence in the field. The test consists of 220 multiple-choice items, covering automatic data processing systems, and quantitative methods. Candidates must achieve a satisfactory score in all categories in order to pass the examination.

Candidates must have at least three years of experience in data processing and must have successfully completed a number of college courses in accounting, mathematics, and statistics.

Sandia Speakers

G. R. Case (5623), "Modeling of Nonlinear Circuit Elements for Automated Circuit Analysis," Joint ACM-IEEE monthly meeting, June 13, Sierra Vista, Ariz.

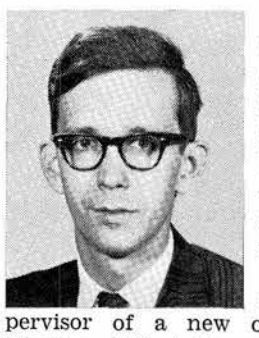
D. W. Sasser and M. L. Slater (both 5262), "Totally Positive Matrices Whose Entries Are Permanental Functions of a Given Matrix," American Mathematical Society, June 18, Victoria, British Columbia.

D. H. Anderson and J. A. Corll (both 5132), "The Chemical Shift of CD^{113} in the NaC1 Phase of Cadmium Sulfide," American Physical Society, June 20-22, Minneapolis.

L. D. Tyler (9321), "Numerical Solution of the Flow Field Produced by a Shock Wave Emerging into a Crossflow," 1966 Heat Transfer and Fluid Mechanics Institute, June 22-24, Santa Clara, Calif.

M. M. Sluyter (9321) and K. J. Touryan (9326), "Thermionic Power Generation from Reentry Vehicles," 1966 IEEE Aerospace Systems Conference, July 11-15, Seattle.

Physicist N. A. Beauchamp Assigned to Bell Labs Weapon Effects Department



Nicholas A. Beauchamp, a physicist in Theory and Analysis Division 5231, has been given a leave of absence to work for Bell Telephone Laboratories in Whippany, N. J.

At BTL Mr. Beauchamp will be supervisor of a new organization in the Weapons Effects Department. Its responsibility will be in connection with the Nike-X program. The department is one of several in the Military Digital Systems Laboratory, whose director, James W. Easley, was on loan to Sandia from June 1960 to October 1964 initially as manager of Radiation Effects Department and later as Director of Radiation Physics.

During his three years with Sandia, Mr. Beauchamp has been interested in radiation transport hydrodynamic problems.

He received his AB degree in physics from Princeton University in 1957, was an assistant professor at Baylor University for the 1961-62 academic year, and was awarded his PhD degree in physics from Vanderbilt University in 1963.

Both Company and Employees Grow Older in Experience

EDITOR'S NOTE: The LAB NEWS published a similar story in 1962. To give you an idea of the change during the past four years, figures from the '62 story are shown in parentheses.

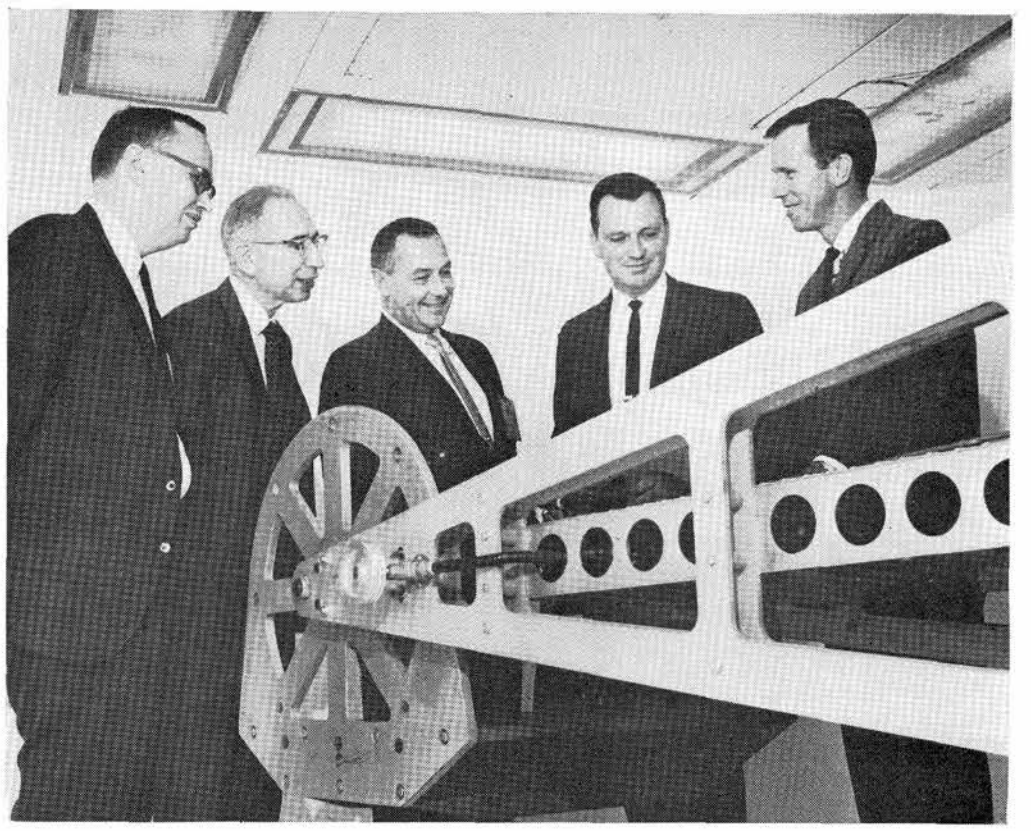
If Sandia's staff seems a wee bit older and also more knowledgeable than it used to be, you're right on both counts—it is.

The average age of the Company employee is just a shade under 41 years (38½), and the average length of service is about 9½ years (7). In fact, 3663 (2535) employees have worked here more than 10 years.

In addition to the on-the-job experience represented by these figures, there are 2698 (2538) college degrees among our employees and of those with degrees one out of 12 (20) has a PhD degree. There were 227 (136) employees with doctoral degrees, 760 (598) with Master's degrees, and 1711 (1804) with Bachelor's degrees, as of May 31 (which excludes summer hires and YOC people).

On the same date there was a total of 8007 (7931) employees on roll, including 963 (1005) at Livermore Laboratory. A further breakdown of the figures showed 2104 (1974) technical staff members, 1420 (1326) technical staff aides, 503 (510) administrative staff members, 294 (208) administrative staff assistants, 267 (276) draftsmen staff assistants, 293 (275) additional non-graded employees, and 3126 (3371) graded employees.

The statistics were provided by Personnel Processing and Reports Division 3153.



TOURING SANDIA FACILITIES during a recent Heat Pipe conference at Sandia was this group of scientists. From left are Martin Gutstein, NASA; Samuel Katzoff, NASA; Peter Rouklove, Jet Propulsion Laboratory; Russell Kunz, Pratt and Whitney Aircraft; and Glen Whiting (9333), conference coordinator. They are examining the 6-foot centrifuge in the Environmental Test Laboratory in Bldg. 860.

'Heat Pipe' Conference Discusses New Device for Space Power Applications

Thirty-eight scientists and engineers from throughout the country attended a one-day conference on "heat pipes" at Sandia Laboratory June 1.

Heat pipes, pioneered by Los Alamos Scientific Laboratory scientists, are essentially heat transfer devices which conduct heat from one end of a hollow pipe to the other with over 90 percent efficiency. They are expected to be used in space-vehicle power system to transfer energy from a heat source, such as a nuclear reactor or isotopic generator, to a thermionic converter for direct conversion into electricity.

Sponsored jointly by the AEC's Division of Space Nuclear System and Sandia's Isotope Power Department 9330, the conference featured the following technical papers:

"Status of the Engineering Theory of Heat Pipes," T. P. Cotter, Los Alamos;

"Heat Pipe Capability Experiments," J. E. Kemme, Los Alamos;

"Development of Heat Pipes for Use with Energy Conversion Device," F. G. Block, W. B. Hall, and R. J. Buzzard, RCA, Lancaster, Pa.;

"Liquid Transport and Heat Transfer Properties of Heat Pipe Wicking Materials," L. S. Langston and H. R. Kunz, Pratt and Whitney Aircraft, East Hartford, Conn.;

"Feasibility Studies of Space Radiators Using Vapor Chamber Fins," H. C. Haller and Seymour Lieblein, NASA, Lewis Research Center, Cleveland, Ohio; and

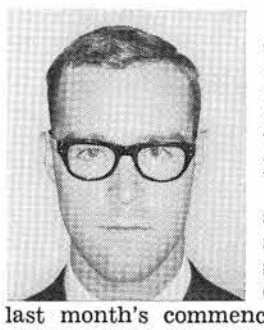
"Notes on Heat Pipe and Vapor Chambers and Applications to Thermal Control of Spacecraft," Samuel Katzoff, NASA, Langley Research Center, Hampton, Va.

"Heat Pipes" are pumps without moving parts which carry excess heat away from the heart of the isotope power systems.

Initial work on the heat pipe principle was performed by LASL scientists. RCA has continued this work for the AEC at its Direct Energy Conversion Department in Lancaster, Pa.

Read Holland (9332), and Glen Whiting (9333) were the conference coordinators.

More UNM Degrees For Sandia Employees



Still more Sandians have diplomas denoting recent completion of degree work at the University of New Mexico.

George D. Alexander (9226) was awarded an MS degree in electrical engineering during last month's commencement exercises at UNM. He received his Bachelor's degree from Missouri School of Mines and Metallurgy and came to Sandia three years ago.

Recent graduates at UNM included John C. Robinson, Jr. (2122), who received a BS degree in mathematics, and Gene Lloyd (3463), who was awarded a Bachelor of Fine Arts degree in art.

CAR AERIAL FLAG bearing good safety advice for the forthcoming three-day holiday is displayed by Maria Telles (3126). Safety Education Division 3212 will distribute the red and green banners to both Sandia and Livermore Laboratory employees today.

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LIVERMORE NEWS

W. L. Frykholm Named V. P. of Management Society

W. L. Frykholm (8212), Livermore Laboratory personnel representative was recently elected vice president of the Santa Clara Chapter of the Society for the Advancement of Management (SAM).

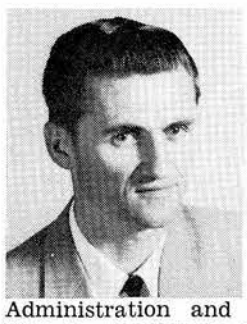
A member of SAM for more than seven years, Mr. Frykholm has been meeting with the local chapter for the past four years. He has been treasurer for the last two years.

Before coming to California in 1962, he helped organize a SAM chapter in Phoenix, Ariz., and was vice president and director of that chapter from 1961 to 1962.

As vice president for the coming year, Mr. Frykholm will be responsible for arranging programs for the Society's monthly meetings. "We are currently developing our overall program for the '66-67 season to emphasize management's role in technical industries," he said. "The program should be of interest to many Sandians."

The Santa Clara Chapter of SAM has an active membership of 35 administrators, engineers, and teachers who meet regularly to discuss new trends in management and to exchange information. The group meets the last Thursday of each month with the exception of July and August in San Jose, Calif. Anyone interested in joining the Society should contact Mr. Frykholm.

Former Mail Clerk Earns College Degree



After six years of evening courses, George W. Perkins has received a BS degree from San Jose State College.

George joined Sandia in 1957 as a grade four mail clerk. He is now an administrative staff member in Security Administration and Operations Division 8241. In the interim he has worked as an order analyst, a planning and scheduling coordinator, and as a staff assistant in the purchasing organization.

George began his college studies in September 1959, when he enrolled in Diablo Valley College. He earned an Associate of Arts degree in business management in June of '62, and entered San Jose State College in the fall of '63. His major was in business and industrial management with a minor in psychology.

This fall, George will begin work at San Jose State on his Master's degree.

Congratulations

Mr. and Mrs. Mike Ferrario (8252), a son, Brian Michael, June 16.

Mr. and Mrs. Carl Furnberg (8131), a daughter, Jocelyn Marie, June 12.

Two New Training Sessions Underway at Livermore Lab

Two new training courses, one on electrodynamics and the other on technical writing, are being conducted at Livermore Laboratory.

The electrodynamics class meets Mondays and Thursdays from noon to 1:30 p.m. in Rm. 237, Bldg. 912. It is being taught by P. H. Lasky, Analytical Division 8149.

According to Mr. Lasky, the class will study electromagnetic fields with emphasis on the application of fields to the areas of plasma physics, weapons effects, and microwave devices. Twenty SCLL employees are enrolled in the class.

The technical writing course is being taught by J. L. Fife, former Sandian and now a consultant to Organization and Manpower Development Department 3130. The 20-hour training session is designed to help the engineer express his ideas more clearly and effectively in written reports, letters, and memoranda. The course covers principles of organizing materials, language usage, and style development.

About 40 employees are enrolled in the technical writing course. They are divided into two classes, a morning and afternoon session, which meet daily in Bldg. 911.

The two courses are designed specifically for Sandia needs, and are not available in the community.

Sympathy

To Nick Nicholas (8152) for the death of his father in Burlington, Iowa, June 11.

To Hans Birnbaum (8116) for the death of his stepmother in Sarasota, Fla., June 14.

Livermore Notes

Tickets are on sale for showings of a new series of foreign and American films. The series is sponsored by the Lawrence Radiation Laboratory Recreation Association Film Society for LRL or Sandia employees and members of their immediate families.

Twelve films will be presented on alternate Thursdays, 8 p.m., beginning July 7 in the LRL Auditorium, Bldg. 111. Selected short subjects will be shown with each movie. All foreign language films have English sub-titles.

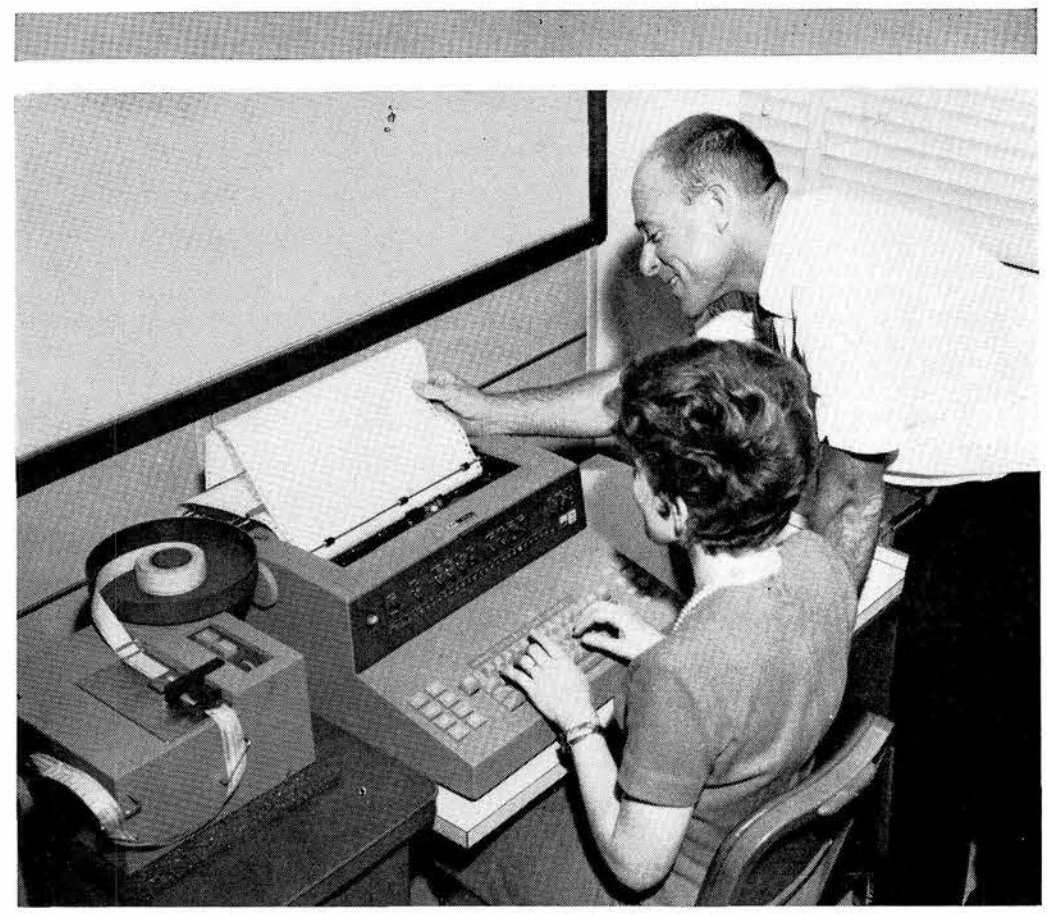
Further information and tickets at $2.50 per person for the entire series are available from LRL Personnel Services, Pat Jordan, ext. 7378.

* * *

E. T. (Bud) Herzog (8154) shot a net low score of 64 to win the first place trophy in the Sandia Employee Golf Club tournament, on June 18. The straight handicap tourney was played at the Silver Pines Golf Course in Newark, Calif.

In the "best ball twosome" feature, Joe Genoni (8235) and Beryl Hefley (8232) tied with M. E. (Mo) Houk (8253) and Bud Herzog with net scores of 60. A special award was won by D. S. Corder (8244) for coming closest to the pin at the 14th hole.

The next SEGC tournament will be held at Tilden Golf Course in Berkeley July 23. Those interested should contact Elmer Smith (8118), ext. 2738; Tom Dadian (8134), ext. 2318; or Joe Genoni (8235), ext. 2433.



INQUIRY AT A REMOTE STATION is scanned for accuracy by W. J. Harrington, Management Systems and Programming Division 8143. Operator Nancy M. Martin (8253) then releases the request to the central computer where Product Definition Record System (PDRS) information is maintained in computer disk storage files. Requested information appears visually in print out form at the remote inquiry station.

Remote Inquiry System Used in Livermore Computer Application

Livermore employees now have fast and direct access to computer storage files without going to the computer center or interrupting the work of the computer operators.

This access is provided by a remote inquiry station which some users of large computers have found to be both useful and expedient.

Under this system, a remote inquiry point is located in an area where there are demands for fast, direct access to the computer storage files. A remote inquiry station typically consists of a keyboard and printer unit and a control unit. Stations may be placed anywhere within a building or dispersed among several buildings.

When the request is entered through the typewriter-like keyboard, it is reproduced on a sheet of paper. Thus data entry can be scanned and/or verified before the key is depressed to release it to the computer. For extensive requests, the data can be punched on paper tape and then transmitted at tape speed.

The first of these remote inquiry stations, an IBM 1050, has been in operation at SCLL since December 1965. It is located in the Product Definition Control System Division 8253 area on the ground floor of Bldg. 912, and linked to the central computer by a telephone-type line.

Two Product Definition Record System (PDRS) files, used by Division 8253, have been maintained in IBM 1410 computer disk storage since 1963. (PDRS is a collection of information pertaining to the parts and components designed by Sandia.) Comprehensive sets of computer programs update these files and prepare all necessary reports. Both of the files contain the same information—in the product record file the items are in product record sequence; in the "used-on," or "where-used," file the items are in part-number sequence.

With the used-on inquiry program, it is possible to obtain complete information about the applications of a part by typing in a password followed by the part number. Knowledge of the password is restricted and the word can be changed easily to control access to the system. The password system was developed in cooperation with the Security Administration and Operations Division 8241 to enable strict adherence to the "need-to-know" policy.

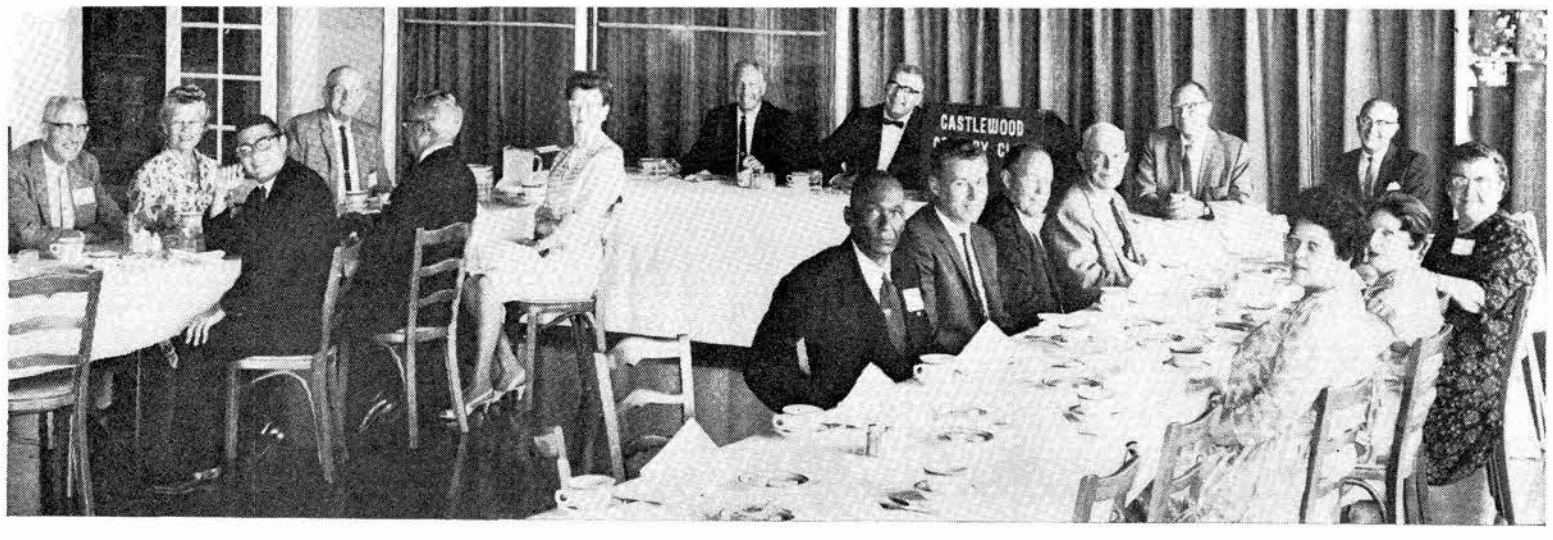
The remote system is used when the computer is operating under its tele-processing monitor system, a normal daytime mode of operation. The input and output speed of the present system is limited to the 14.8 character-per-second capability of the 1050 printer.

When the 1050 signals the computer, the main-line program is interrupted. The 1050 request is completely processed with the answer drawn from the PDRS used-on file and printed out at the 1050, after which the main-line program is restored to operation at the point of interruption. This is all accomplished without intervention by the computer operator. One request will produce all of the occurrences of the requested part number. Several variations or options to the basic procedure may be used to obtain more specific information.

W. J. Harrington of Management Systems and Programming Division 8143 planned and wrote the PDRS inquiry programs, and F. L. Whitworth of Numerical Applications Division 8144 performed the necessary systems programming for the remote station.

Work is underway to develop the remote inquiry system and other applications for the CDC 3600 computer. Remote equipment, being considered for the 3600 computer, includes cathode ray tubes which will operate at far greater speeds than the system now in operation.

SUPPLEMENTING MEDICARE with Sandia's special health insurance plan was the topic of a meeting with Sandia retirees and their spouses in the Bay Area. Attending the luncheon meeting on June 9 were William J. Barlow, Mr. and Mrs. Audie J. Cowan, Mr. and Mrs. Irving C. Ellicott, Mr. and Mrs. Stanley M. Krell, Mary Agnes Van Brocklin, and Mr. and Mrs. Will B. Williams. D. E. Irvin and B. W. Strausberg of Employee Benefits Division 3122 discussed details of the new medical coverage which is being made available on an optional basis. Greeting the retirees and assisting during the meeting were C. H. DeSelm (8200), F. R. Moon (8240), H. C. Malmquist (8222-1), and D. D. Wagner and W. J. Henderson of Benefits Division 8211.



Albert Einstein -

THE SCIENTIST AND THE MAN

By C. C. Hudson (5590)

PART IV

Einstein considered the relativity theory to be his greatest achievement, but his other discoveries have led to many practical innovations, and interacted directly with quantum theoreticians. These interactions brought about a famous dialogue with Neils Bohr and resulted in formulating ideas that have had a most profound effect on modern thinking, both in science and other fields.

In point of time, Einstein's first great paper was the photoelectric effect. However, because it leads into other things, it is deferred to later in this discussion. An important contribution to molecular kinetic theory was his study of the Brownian motion. The biologist Brown had observed in 1928 that when a pollen or other finely divided material was observed in a well-lighted field under a suitable microscope, some particles could be seen to be dancing or moving rapidly about. After a number of incorrect efforts, the idea was finally suggested, in 1888, that these particles were showing the effects of molecular agitation, but it was 17 years later that Einstein described quantitatively what was being observed.

R. A. Millikan writes: "We physicists before the time of Einstein had been extraordinarily blind in our failure to realize that there could be no reason to limit the principle of equipartition (of energy) to bodies of atomic or molecular dimensions; that instead it should make no difference, on the basis of equipartition, whether the particles which were exchanging impacts with the molecules of a gas or a liquid which surrounded them were as big as an atom or as big as an orange." Einstein made the radical assumption (also made independently by two others) that the pollen grains or other material shared the kinetic energy of the liquid with its molecules, and then derived expressions to describe the grain motion. Since this is a statistical process, the grain jumps this way and that an sort of "random walk." Most of the individual jumps occur too quickly to see with the eye, but a succession of jumps in the same direction appears as visible motion and the grain seems to dance. In later papers, Einstein generalized the ideas of the Brownian motion and predicted the existence and character of noise in electrical circuits.

From the earliest days, workers in gas discharges have been aware of the effects of photoelectric emission, if not aware of the cause. Hertz, in the 1880's, observed that an electrode exposed to light breaks down (becomes conductive) more readily than one in the dark; J. J. Thomson, Rutherford, Townsend—all were familiar with the effect. It was Phillip Lenard, later to be Einstein's enemy, who made the experimental discovery and for it received the Nobel prize.

Experimental Facts

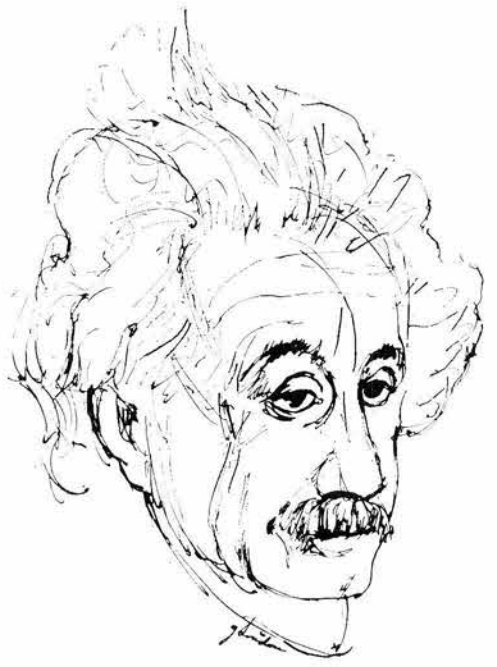
When light falls on a clean metal surface, electrons can be emitted. The number of electrons depends on the intensity of the light, but the energy of the electrons depends on the wavelength, of the light; the shorter the wavelength, the greater the energy. In fact, if the wavelength is too long, no electrons are emitted. And, finally, there was no measurable time delay between turning on the light and the emission of electrons.

To appreciate the boldness of Einstein's solution, we must recall some further properties of waves, because light was well documented as a wave motion. A wavefront covers an appreciable area and, when intercepted by an obstacle, can bend around the edges (diffraction). Also, since light waves consist of oscillating electric fields, when the field strength of one part of the wave is positive and that of another part is negative, the superposition of these two parts results in cancellation; i.e., no intensity. Electrons can be set in motion by the electric field of the light wave, but how can they be accelerated so as to jump out of the metal? Why are not all the billions of electrons in the metal excited? How can the wave affect only one?

Einstein, steeped in the tradition of classical electromagnetic theory, but aware of the recent quantization of energy by Planck, made two revolutionary assumptions: First, light is quantized; and, second, the quantum elements of light act like particles, not like waves. Thus, he suggested, a photon (light particle) can hit a particular electron and knock it out of the atom. He described the photon's energy as hv where the v is the photon frequency and h is Planck's constant. Then it was reasonable to write

$$h(v - v_o) = KE$$

where v_o is a threshold frequency and KE is the kinetic energy of the ejected electron.



Albert Einstein probably most closely fits the public image of a scientific genius. A versatile and profound scientist, his most famous theories relate to relativity, gravitation, and light.

This is the final installment of a four-part series about Einstein—As a Man—and His Works.

There was insufficient experimental capability in 1905 to test Einstein's equation and, except for inspiring other theoretical ideas, the photoelectric equation languished. After all, it was hardly in a form suitable to apply rigorously to the metals where the effect had been observed. But R. A. Millikan rose to the challenge. Later he wrote, in tribute to Einstein: "I spent 10 years of my life testing the 1905 equation of Einstein's and, contrary to my expectations I was compelled in 1915 to assert its unambiguous experimental verification in spite of its unreasonableness, since it seemed to violate everything we knew about the interference of light. The contradictions between this equation could not be removed by any considerations that were available at that time to Planck, to Einstein, or to any of the rest of us." So the photoelectric equation was verified, and now has become a standard part of electrical engineering, being basic to phototubes, light meters, television image tubes, etc. But what had he done to physical theory?

Interpreting Light

After Einstein's quantization of the electromagnetic field was established experimentally, physicists were faced with interpreting light either as corpuscles or as waves, concepts that were poles apart. Even more than Planck, Einstein had brought into sharp focus the mysterious character of the microscopic world. To this day, the dual nature of light has not been completely resolved. When single photons act, they act like corpuscles, but when many photons form a beam, they act like waves. The wave nature of the photon is evident in the expression of its energy in terms of a frequency or wavelength, but efforts to formulate a model of a photon that will have both corpuscular and wave properties have not been fully successful.

And what has replaced the aether that Einstein's relativity theory rejected as the medium of light propagation? It has not been replaced. As Feynmann says: "Maxwell discussed his ideas in terms of a model in which the vacuum was like an elastic solid. He also tried to explain the meaning of his new equation in terms of the mechanical model. There was much reluctance to accept his theory, first because of the model, and second because there was at first no experimental justification. Today we understand better that what counts are the equations themselves and not the model used to get them. We may only question if the equations are true or false. If we take away the scaffolding we used to build it, we find that Maxwell's beautiful edifice stands on its own." It is no longer popular among scientists to discuss the medium of propagation.

In 1907, the quantum theory again received a big push from Einstein in the form of a quantum analysis of the specific heat of solids. The amount of heat that must be added to a body of mass m to change its temperature from T_1 to T_2 is

$$Q = am(T_2 - T_1),$$

where a is called the specific heat of that solid. For many solids, especially at high temperatures, a has the value 6 calories per degree C if m is a mass of the material equal to the molecular weight. This is called the Dulong-Petit law. Unfortunately there are numerous exceptions.

To attack the exceptional cases, Einstein assumed that classical statistics, which readily gave the Dulong-Petit law, did not hold; that one had to introduce the quantum concept in the form of Max Planck's formula for the mean energy of one oscillator. Here the oscillator is interpreted to be the vibrating atom or molecule of the solid restrained in its lattice. Remember that Planck's formula contains a mathematical term of the form exponential (hv/kT); if kT is larger than hv (for high temperature), Einstein's new equation became equivalent to the Dulong-Petit law. If hv is less than kT, however, a new form of the specific-heat law was obtained which tended toward zero as the temperature approached absolute zero. Here kT represents the temperature of the solid and its surroundings while hv represents the energy of the molecular oscillator. The great Berlin scientist, Nernst, who specialized in thermodynamics and questions of heat, put Einstein's theory to the test, and proved its major features. Some modifications were still necessary, especially for the specific heats of metals, but Einstein clearly showed the way and established the basis of the modern theory of solids and metallurgy.

Einstein devoted many more papers to the study of photons or light quanta. Technically, one of his important achievements was the statistical study of quanta which resulted in the well-known Bose-Einstein statistical law which may be applied to particles without spin, like photons and atoms. The corresponding law for particles with spin (like electrons) was formulated by Fermi and Dirac. A description of these theories of statistics would be tedious and out of place here.

In 1917, Einstein deduced that, under certain conditions (that the atoms of radiating medium had appropriately spaced levels), stimulated emission could take place. Usually atoms emit spontaneously in a very short time (about 10^{-8} second) after excitation. Since the excitation is random, the photons have random phase when emitted spontaneously. Einstein considered a cavity filled with atoms in equilibrium with radiation. By assuming the Boltzmann distribution law for the atoms and the Planck distribution law for the radiation, he deduced an additional term for the probability of emission which was proportional to the radiation intensity. The higher the intensity, the more probable the emission. In short, the emission was stimulated or induced. By selecting materials that have special long-lasting excited states and using an outside light source for stimulation, the effect is greatly exaggerated to form the maser or laser, where the emitted light has great coherence, or is in phase. The importance of this concept is only recently being appreciated.

Neils Bohr

It is important to mention here Einstein's long dialogue with Neils Bohr. In the 1920's it was recognized that massive particles like electrons and protons exhibited the same dual or complementary properties that had been recognized in photons, that is, that they sometimes acted like particles and sometimes like waves. This duality resulted in the formulation of a kind of mechanics for subatomic particles in which the classical ideas of motion had to be given up, and trajectories were represented by probability functions. While it has not been possible to reconcile the two properties of microscopic matter in a single formalism, still the mathematical structure that grew up served so well to solve problems that most physicists have been willing to ignore the disparity. But not so with Einstein.

The dialogue began in 1920 when Bohr first met Einstein in Berlin and was continued throughout the 1920's and into the 1930's, especially at the famous Solvey Congresses. These meetings were sponsored by a wealthy Belgian industrialist, Solvey, to further the development of scientific research. Here Einstein, Bohr, and many of the bright young men of those days argued about the basic questions of physics. In particular, Einstein posed a number of extremely clever thought-problems intended to expose the weakness of quantum theory based on probability arguments. Most of these Bohr solved without having to give up the probabilistic interpretation. It was ironic that he disposed of the questions by using the very technique that had served Einstein so well in developing relativity theory, i.e., the removal of all ideas about unobservable quantities.

However, Einstein was not persuaded. In a famous 1935 paper, in collaboration with his colleagues Podolsky and Rosen, he stoutly defended his previous views and concluded that quantum mechanics does not "provide a complete description of the physical reality." Bohr, of course, sought to obtain the opposite conclusion, and wrote "From our point of view we see now that the wording of the criterion of physical reality proposed by Einstein, Podolsky, and Rosen contains an ambiguity as regards the meaning of the expression 'without in any way disturbing a system.'"

Bit by bit, Einstein was forced to give up the technical grounds on which he would have liked to make a stand, and finally sought sanctuary in the position that the probabilistic basis of quantum mechanics "is so very contradictory to my scientific instinct that I cannot forego the search for a more complete conception." His last intransigent word was written in 1948.

"Above all, however, the reader should be convinced that I fully recognize the very important progress which the statistical quantum theory has brought to theoretical physics. In the field of mechanical problems, this theory even now presents a system which, in its closed character, correctly describes the empirical relations between statable phenomena as they were theoretically to be expected . . . What does not satisfy me in that theory, from the standpoint of principle, is its attitude toward that which appears to me to be the programmatic aim of all physics: the complete description of any (individual) real situation (as it supposedly exists, irrespective of any act of observation or substantiation)."

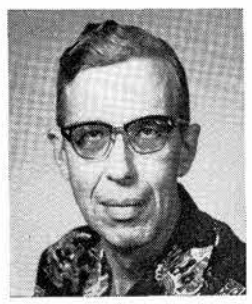
Einstein was fully aware of the contradiction with the positivistic or empirical approach to physics wherein theoretical ideas had to be related to observable quantities, but he described certain fundamental situations in which he thought it necessary to be able to reason beyond the realm of observation. Many people believe the later arguments of Einstein took on a metaphysical, rather than physical, aspect. Nonetheless, there is today a small but dedicated group of modern theorists still working on the quest to eliminate the probabilistic ideas from quantum mechanics.

No one can live a full life without personal conflicts, but as a rule scientists avoid excesses because their work tends toward objectivity rather than values. It was not so with Einstein. Almost from the beginning of his career he was thrown into personal conflicts. Some conflicts were friendly and fruitful such as with Bohr; and the two men remained lifelong friends. Others, as with the Nazis, were bitter.

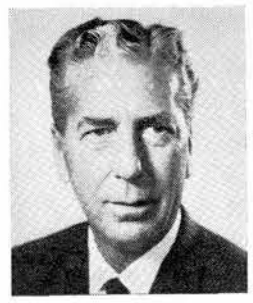
Particularly disappointing was the vendetta conducted against Einstein by Phillip Lenard, a fellow Nobel prize winner. Lenard wrote, "Einstein's relativity theory was to transform and dominate all physics but when faced with reality it has no leg to stand on. Nor was it intended to be true. In contrast to the equally intractable and solicitous desire for truth of the Aryan scientist, the Jew lacks to a striking degree any comprehension of truth." Toward the end of Einstein's stay in Berlin, Lenard attacked him more and more on personal grounds. Another German physicist, Johannes Stark, also a Nobel prize winner, became hostile toward Einstein. Although he did not attack him personally, he banned his books and tried to prevent Einstein's theories from being taught in German schools. Einstein, however, emerged with equanimity from these harrassments to become the outstanding figure in 20th Century science.

Service Awards

20 Years



P. L. Dailey
7245



J. R. Heaston
7261

15 Years

R. L. Ballard
8211

L. B. Converse
8122

Dorothee Drury
3412

H. B. Durham
5590

Dan Fenstermacher
7224

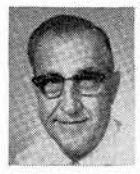
A. J. Fisher
4252

J. W. Grear, Jr.
1334

R. G. Hamilton
7331

J. H. Lackey, Jr.
2212

W. A. Little
8250



M. E. Ludeke
7213

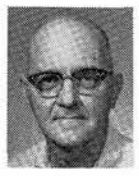
F. R. Martin
9214

Eleanor McPhate
4131

R. K. Parry
2443

T. F. Pfeffer
2554

C. J. Ricker
3113



C. C. Riley
4221

W. A. Sherman
2114

J. D. Smith
7232

Mildred Smith
4233

F. E. Thompson
9234

J. R. Tolmie
7532

F. X. Vogel
4541

10 Years

July 1 - 14

R. B. Abbott 1524, J. H. Leroy III, 2223, J. L. Hartley 2411, B. F. Sedlack, 2443, D. L. Hughes 3134, N. W. Scott 3243, P. S. Young, 7331, T. B. Lane 8110, R. L. Eno 9222.

L. L. Pierce 1132, R. C. Lindsey 1422, G. W. Holmes 7335, R. W. Summers 7343, K. F. Lindell 2234, Betty B. Sherred 4135, J. L. Irwin 5632, J. L. Bloomquist 9234.

M. G. Martinez 4614, C. D. Lundergan 1115, E. P. Bernard 3242, R. P. McKnight 7255, P. W. Blaylock 9226, Mina L. Carnicom 9326, R. O. Brooks 7341, Agnes F. Birosak 2234, E. T. Cook 2525, and J. B. Sanchez 4613.

Sympathy

To N. J. Eich (1100) for the death of his wife in Albuquerque, June 23.

To Phyllis Neff (4152) for the death of her father in Ruidoso, June 25.

Take Note

Frank H. Grubbs, former manager of Sandia's Electronic Data Processing Department, was ordained as a deacon in the Episcopal Church, June 18. He has been named curate of St. Nicholas' Church in Midland, Tex., and vicar of St. John's Church in Mesa, Tex.

The Rt. Rev. C. J. Kinsolving III, bishop of the Diocese of New Mexico and Southwest Texas, officiated at the ceremony in St. John's Cathedral, Albuquerque.

Mr. Grubbs had been with Sandia for 13 years at the time he terminated in September 1963 to attend Seaburg-Western Theological Seminary in Evanston, Ill.

* * *

Members of the Albuquerque City Commission have approved the appointment of J. Robert Garcia, supervisor of Organization and Manpower Planning Division 3133, to the city personnel board.

He will fill the term of D. J. Jenkins (3130), who has resigned from the five-member board. The term will expire June 24, 1968.

Events Calendar

July 1 and 2—"Roar of the Greasepaint, Smell of the Crowd," 8 p.m., Light Opera Playhouse, 113 Alvarado NE.

July 2, 8, and 16—Puccini's "Tosca," Santa Fe Opera.

July 4—American Legion fireworks display, 8 p.m., UNM stadium.

July 6 and 9—Rossini's "Cinderella," Santa Fe Opera.

July 8—Albuquerque Symphony Orchestra "Jazz for a Hot Summer Evening," 8:15 p.m., Civic Auditorium.

July 8-10, 15-17—"You Can't Take It With You," Corrales Adobe Theater.

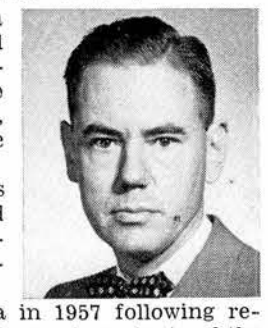
July 11—UNM Lecture Under the Stars, H. D. Meyer on "The Impact of Leisure on American Society," 8 p.m., Administration Bldg.

July 14-17—Rodeo de Santa Fe, south of Santa Fe.

July 14—Feast Day and corn dance, Cochiti Pueblo.

July 14-17, 20-24 — Steinbeck's "Burning Bright," Old Town Studio, 1208 Rio Grande NW, 8 p.m., for reservations, tel. 242-4602.

Deaths . . .



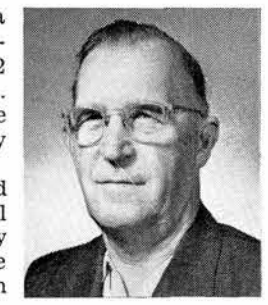
John F. Buyers, a member of Field Engineering Division 7531, died June 14 in a Cleveland, Ohio, hospital. He was 45.

Mr. Buyers was on sick leave and had undergone surgery the week before.

He joined Sandia in 1957 following retirement from the Army. A graduate of the U.S. Military Academy, funeral and burial services were held at West Point, N.Y.

Survivors include his widow, two children, his mother (all of Albuquerque), and a brother in Los Angeles.

* * *



John England, a retired Sandia employee, died June 22 at the age of 73. Burial was at the National Cemetery in Santa Fe.

Mr. England had been a mechanical inspector for nearly 10 years at the time of his retirement in 1958.

Survivors include his widow, a son John (2223), a daughter, Nancy (3126), and six grandchildren, all in Albuquerque.

* * *

Emily Gilmore, a technical clerk in Product Data Control Division 2432, died June 25. She had been employed at Sandia since September 1952.

Survivors include her husband, two sons, a stepson, three step-daughters and seven grandchildren.

Arts and Crafts Fair

At least one Sandian was delighted with the recent New Mexico Arts and Crafts Fair in Albuquerque. Joe Rivard (5223), who displayed his paintings in two adjoining booths at Old Town, reports his works sold "very well." Included in his exhibit (mostly landscapes) were four large oil paintings, two pastels and two pen and ink drawings, and two wood cuts. One of the pictures sold was "Chorus of Rocks" which illustrated an article about Joe's paintings in a January issue of the LAB NEWS.

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2. **One ad per issue per person**
3. **Must be submitted in writing**
4. **Use home telephone numbers**
5. **For Sandia Corporation and AEC employees only**
6. **No commercial ads, please**
7. **Include name and organization**
8. **Housing listed here for rent or sale is available for occupancy without regard to race, creed, color, or national origin.**

FOR SALE

17" RCA portable TV, new picture tube, $40. Westman, 255-6048.

'57 FORD V8, 4-dr. Fairlane 500, AT, PS, R&H, best offer over $275. Hawkinson, 243-2686, Mon.-Fri. 5-7.

RANGE, Kenmore deluxe electric, two ovens, four burners, rotisserie, automatic timers and plugs, meat thermometer, large grill, white. Armijo, 256-1629 after 5.

'64 HONDA motorcycle 305cc, electric starter. Sundberg, 268-6435.

'56 FORD sedan, $200; '54 GMC Carryall, $400; will consider any cash offer. Gels, 298-2059.

BOAT, '65 Lone Star Mustang, Evinrude motor, Snoco tilt trailer, tarp and complete ski equipment, life jackets. Young, 256-1361.

'63 RAMBLER Amb. deluxe, approx. 37,000 miles, $1200; registered thoroughbred gelding, 11 yr. old, well trained, $250. Hamm, 282-3204.

'61 CHEV. Greenbrier bus, 3-speed, $675; large glass grape clusters, several colors, $12.95; need home for kittens. Brumley, 877-2667.

STEEL SASH window, 50x52 w/glass and screens for both openings, $25. Sundt, 256-3220.

18" POWER LAWN MOWER, needs some repair but has good motor, $5; NMMI uniforms; Hollywood bed frame and headboard. Wheeler, 256-6230.

'63 TAHATSU motorcycle, $100 or will trade for guns or Totegoat. Keating, 255-9961.

3-BDR. HOME, sell or rent; 1052 Betts NE, Princess Jeanne, near schools. Peel, 265-4205 after 5.

3-BDR., den, fp, 1¾ bath, carpet, drapes, FHA $17,925, will sell for $16,700, 1808 Indiana NE. Lundergan, 256-2368 after 6.

WARDS Garden Mark gasoline mower, rotary type, $40. Wade, 256-6555.

2-BDR. HOUSE, pitched roof, attached garage, landscaped, $350 down FHA, near Fair Plaza. Graff, 265-8456.

BABY BED w/two lowering sides; child's spring (Wonder) horse. Hall, 299-0009.

MATCHED SPEAKERS in walnut cabinets, $50 pair; B&H 8mm zoom lens, grip case, $50; trade for 8mm projector. Butler, 299-5626.

REFRIGERATOR, GE, 14 cu. ft., coppertone finish, used 10 mos., $260 new, sell for $150. Robertson, 296-4613.

'61 PLYMOUTH 4-dr. 6, white, new brakes, transmission and seat covers, $490. Allison, 298-6584

20 GAUGE SHOTGUN shell loading outfit. Sievert, 255-7367.

'64 JAWA motorcycle, 125cc, 4600 miles, crash helmet, $185. Brossard, 298-7783.

'58 PEUGEOT sedan, $175. Bruington, 255-6164 after 5.

1 ACRE N. Rio Grande; ping pong table; new LeBlanc clarinet. Ortega, 243-2687.

'58 MOUNTAINEER trailer, 8'x48', 3-bdr., AC; Sand point well driving rig mounted on '56 Chev. pickup, up to 3" pipe, pressure tank for cleaning wells. Williams, 865-7968.

'53 CHEVROLET 2-dr. coupe. Rutledge, 282-3151 after 5.

BLACK STANDARD POODLE puppies, sire champion Carlin Chancellorsville (Carillon line bred) Meriwick's Bombachas De Lawa (Astron bred). Randle, 255-9424.

SELL OR TRADE for larger car: '63 VW. R&H, w/w tires, 24,000 miles. McElvaney, 255-9468 after 5.

BABY WALKER, all metal youngster's pool table; set of hammered aluminum pots. Kochmann, 299-5133.

'64 STUDEBAKER economy 6, 2 dr., 18,000 miles, $850. Ewing, 268-0772.

'57 OLDS 4-dr. Holiday sedan, power and air, needs valve job, $175. Chase, 299-4982.

'61 OLDS 98 4-dr. HT, factory air, PS, PB, $1025, 9700 Morrow Rd. NE. Cooper, 299-7157.

SIMMS RANCH, Los Poblanos Estates, 3-acre residential lot w/trees, paved road, terms, evenings and weekends. Stein, 242-2967.

'56 DODGE station wagon, R&H, AT, one owner, $275. Isidoro, 877-4440.

BEDROOM SET: dbl. bed, dresser, chest, $80; Danish modern sofa, $25. Varnado, 298-7334.

UNFINISHED HOUSE and five acres, Los Lunas area. Rameriz, 865-7467.

BASSINET w/pad, new liner, $11; infanseat, $1.50; car seat, $1.25; 8x10' braided rug, $6. Caudle, 298-9120.

SWIMMING POOL 20' dia., 4' deep, metal walls, plastic liner, ladder, cover, used 2 seasons, $75. Jones, 299-2889.

'62 AMC upright freezer, $150; ¾" birch plywood, $5; steel casement window and screen, $5. Wagoner, 299-6801.

'57 CHEV. station wagon. Berry, 898-1400.

3-BDR., den, 1¾ bath, AC, sprinklers, near Winrock and schools, quick possession. Seay, 299-5270.

GREY PUREBRED ARABIAN colt, champion bloodlines, an opportunity to get in the "Blues" at a reasonable price. Galbreath, 898-0644.

PORTABLE Remington typewriter, case, $50; beginners ¾ violin w/Kolitch shoulder rest, case, $50. Savage, 256-7263 after 5.

17" TELEVISION, '62 Packard Bell w/portable brass cart, $75. Stirbis, 299-5363.

CIRCUIT BREAKER and load center, Westinghouse, LO020DS/door, ½ price; wheelbarrow, $4; occasional chair, $5; 15 cu. ft. Amana upright freezer, 2½ yrs. old, $150. Ruff, 317 Gen. Bradley, NE.

BABY GRAND PIANO, new strings and pins, $850. Foster, 296-2358 after 5.

FROST ROAD, 5 or 10 acres, water, electricity, trees, $800; new El Camino 4-speed, large motor, R&H, snow tires, white cover, $2200. Browne, 344-9675.

'64 FORD GALAXIE 500, 2-dr. HT, V8, "390" 4-spd., PS, R&H, white sidewalls, under NADA, light blue. Nelson, 255-2364.

'55 CHRYSLER 2-dr. HT, R&H, AT, PS. Reinman, 256-9737.

'55 PLYMOUTH 4-dr.; classic '37 Dodge, runs good, all dents removed, sanded and primed, ready for paint. Stake, 255-0610.

4-BDR., 3 baths, LR w/fp, DR, family room w/fp, dbl. garage w/storeroom, enclosed 3-level patio w/teahouse, landscaped, sprinklers, SE near schools, $25,000 appraisal. Shearin, 268-9211.

'59 FIAT 600 sunroof, new engine and brakes by Jerry Unser, 40 mpg. Sluyter, 298-5844.

TWO EACH 6:50x16 six-hole used tires w/rim; 2 each 6:70x15 tires w/rim. Smith, 877-9399.

TUCK-A-WAY telescoping camper, 8', sleeps 2, stove, ice box, furnace, $1195. Machen, 298-1698.

MOUNTAIN RESIDENCE w/7 acres on Hiway North 10 at Cedar Crest; 12-volt car cooler; '54 DeSoto Wagon. Barth, 345-0172.

MOTORCYCLE, 75cc, oil injected, '63 model, 4000 miles, 125/mpg, first $150 takes it. Duvall, 299-8744.

'55 CHEV. station wagon, 6-cyl., stick shift, $150. Zucuskie, 268-0195.

ENCHANTED HOME, 3-bdr., 1¾ baths, paneled den w/fp, built-ins, carpeting, near Mitchell Elementary, $21,200, $2700 down, 5¾% FHA. Tucker, 298-8024.

MOSSMAN 3-bdr., hw/f, fp, carpet, drapes, patio, Zoysia lawns, 2812 Maderia NE. Hunter, 256-7610.

3-BDR., DR, single car garage w/utility area, AC, completely carpeted, landscaped, sprinklers, low down or trade, $13,850. Workman, 298-8201.

CUSTOM BUILT 3-bdr., den, DR, 1¾ bath, fp, AC, built-in stove, landscaped, near schools, 1008 Luthy Circle, NE. Cron, 298-0515.

ROTH VIOLIN, full size, w/case, includes shoulder rest, $50. Looney, 255-7349.

SELL OR TRADE for smaller tent: 10x16' clear center umbrella tent w/extension sides and sewn in floor, used very little, complete w/all poles and stakes. Burger, 256-3789.

4-BDR. HOUSE, $33,700; 6% loan, full bath, ¾ and ½ bath, dbl. garage, shake shingle roof, covered patio, luxury features. Goodman, 299-3652.

ELECTRIC WIRE, outdoor, approx. 500' No. 12, 500' No. 10, 100' No. 6; misc. building material. Toya, 125 El Pueblo Rd. NW, 898-0491.

'56 OLDS, 4-dr. HT, AT, R&H, PS, $200 or best offer; Frigidaire automatic washer, $35. Breitenbach, 268-7900.

DRAPES: 1 pr. white background w/aqua and gold print; 1 pr. solid green. Bartlett, 299-4861.

3-BDR., 1 bath Mankin, NE Heights, assume 5¼% FHA loan, near schools, shopping and buses, $700 down, $95/mo. 1435 Espejo NE. Haynes, 298-6551.

ADOBE HOUSE, 48 acres, near water skiing, fishing, San Luis, Colo.; 3½ acres and city lot, Taos, N. Mex. Chaves, 255-6155.

SHOPSMITH model 10E, complete w/jig saw, shaper and jointer, $150. Gustafson, 299-3270.

FULLY EQUIPPED 8-gal. aquarium showcase tank w/2 aerator pumps, tropical fish, snails, $15. Evans, 268-8419.

'55 MERCURY station wagon, $75. Foster, 265-0069.

SELL-RENT-LEASE: 4-bdr., NE home, 1¾ baths, den w/fireplace, walled backyard, dbl. garage. Burns, 242-2407 after 5:30.

13 CU. FT. Frigidaire refrigerator, $45; 18 cu. ft. freezer, upright, Westinghouse, $135. Wise, 298-2123.

'55 JAWA motorcycle, 250cc, 1000 miles, $400; 23" Silvertone TV, $35; '55 Oldsmobile, $200; 5-yr. or 2-yr. mare, $200. Shock, 877-3728.

'62 FORD WAGON, Cruisamatic, PS, R&H, 5 seat belts, extra rim w/mtd. snow tires, overload spr., $950 or best reasonable offer. Pierce 298-0781.

'58 CHEV. pickup ½-ton, 4x8 bed, V8 motor, R&H, $500. Berger, 255-0265.

'64 CORVAIR MONZA club coupe, big engine, 4-speed, R&H, 14,000 miles, original owner, $1375. Gregory, 268-2022.

'62 FORD 2-dr., HT, new 406 engine, 3-2's, 3 speed w/OD, new tires, $1095. Tarbell, 256-1322.

SIX-MONTHS OLD Doberman, female, champion lineage. Hill, 268-1420.

RENTED 2-bdr. house in NE. $700 investment. Cotter, 265-8631.

WANTED

AIR COMPRESSOR, large enough for auto painting (approx. 7 cfm); also want female Toy English Bulldog, will buy or breed yours for pup. Clark, Los Lunas, 636-2569.

JOIN car pool from vicinity 1600 block Central or Coal SE to Bldg. 800 parking area. Cantwell, 243-0303.

RIDE from Westgate Heights to gate 5 or 6. Weitzel, 855-9454.

ROLLEIFLEX LENSES for Exacta or Minolta SLR; 8mm projector; Travel Queen camper. Butler, 299-5626.

OLD hunting knives of any kind or condition, will pay cash. Smitha, 8607 Menual NE., 299-1096.

CHILD CARE, your home, full or half days, mature responsible woman, references, younger children preferred, after July 10th. Ullrich, 255-3367.

AIR COOLER (6500 cfm down draft), twin beds, knock-off hub type Mustang wheel covers; have stereos for trade or sale, also baby bassinet. Chandler, 296-3167.

TWO metal swing seats for children's outdoor swing set. Bruno, 255-8339.

CB transceiver and accessories. Terry, 299-4607.

GOOD HOME for affectionate male puppy, Dachshund-Terrier cross, good w/children. Reilly, 898-0069.

GOOD HOME for brown Terrier 4-yrs. old, likes children. Batchelor, 299-4831.

FOR RENT

OFFICES FOR LEASE, single or suites, answering service, secretarial service, all utilities paid, relaxed business atmosphere w/swimming pool, $60/mo. up. Welch, 299-8764.

HOUSE, reasonable rent, 514 Girard SE. Gabaldon, 255-8274.

3-BDR., 1¾ bath, AC, newly redecorated, $135/-mo. Massey, 298-1468.

ONE HALF of double garage, 9028 La Barranca NE. Boice, 299-3260.

FURNISHED apartment, 5 min. from base, AC, $80/mo. Cordova, 256-2073.

LARGE HOUSE, Placitas, country living, just remodeled old adobe, garage, corral, fruit trees, new school, all utilities available. Illing, 299-7378.

2-BDR. unfurnished apt., hw/f, large kitchen w/lots of cabinets, near Base, $85/mo. w/lease, $95 wo/lease. McCall, 268-6210 after 5.

LOST AND FOUND

LOST—Prescription bifocal safety glasses, gold ring w/black star sapphire and Chinese characters, left-handed baseball glove w/name N. F. Siska. LOST AND FOUND, tel. 264-2757, Bldg. 610.

CELEBRATE INDEPENDENCE DAY at the Coronado Club family picnic July 4 from 1:30 to 7 p.m., says the Max Newsom family. Max (5611) is president of the Coronado Club board of directors. The picnic is free to Club members.

At Coronado Club . . .

Fourth of July Traditional Picnic

Celebrate a grand and glorious Independence Day with an old fashioned family picnic at the Coronado Club. Free to Club members, the event will start at 1:30 with hot dogs, baked beans, chocolate cake, and Coke. After the goodies, plenty of games are planned for the kids. The fun will last until 7 p.m.

On July 7, teenagers will go-go with sparkplug Don Lincoln of KQEO managing the action. The Bandeliers will provide the music from 7:30 to 10:30. Admission is 25 cents each.

On Saturday, July 16, the Club will feature a do-it-yourself costume party billed as a "Come As You Are" event. The word is "come on out in something cool, catchy, or kookie." The evening starts with dancing to Tommy Kelly's music from 9 to 1 with time out for steak and eggs from 11 to 12:30. Reservations needed for this one, and tickets must be picked up by 9 p.m. July 15.

Social Hours

Tonight, Max Madrid will provide the happy music and set the scene for the Mexican buffet. Buffet costs $1.25 for adults, $1 for children.

Next Friday, July 8, Elaine Harris' combo will play for social hour and the popular chuckwagon roast beef and shrimp buffet will be served. Prices are $1.75 for adults, $1.50 for kids.

On July 15, Tommy Kelly will provide the music and the seafood buffet will head the menu.

Bridge

ACF bridge meets Wednesday, July 6, at 7 p.m.

The Ladies Bridge group meets Thursday, July 7, at 1:15 p.m.

On Monday, July 11, the Individual Championship Bridge tourney will be held. Dinner at 6 p.m. with the tourney starting at 7.

Congratulations

Mr. and Mrs. Robert Hatcher (4574), a daughter, Margaret Lorie, June 10.

Mr. and Mrs. H. H. Pike (2431-1), a daughter, Stacy Jean, June 21.

AMONG MODELS participating in a mother-daughter fashion show at a Sanado Club meeting July 12 will be Mrs. H. F. Gustafson and daughter Carolann. The style show will feature casual summer fashions.

Mother-Daughter Luncheon For Sanado Club July 12

Annual mother-daughter luncheon of the Sanado Club will be held Tuesday, July 12, at 1:30 p.m. at the Coronado Club. A fashion show, featuring mother-daughter models, will highlight the meeting.

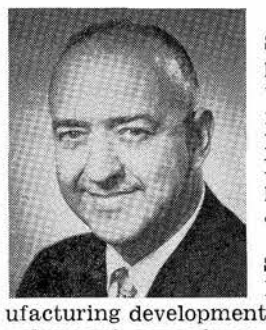
E. E. Ives (5621), accompanied by Mrs. L. E. Mahuron at the piano, will present a selection of vocal music.

Mrs. C. C. Fornero is chairman of decorations. "A Rhapsody in Color" will be theme for hanging wicker baskets filled with flowers. Table decorations will be floating flowers creating a lily pond effect.

Pouring at the sherry and punch table will be Mrs. G. W. Treadwell, Mrs. J. A. Anderson, and Mrs. Fornero.

Reservations close Friday, July 8, and should be mailed to Mrs. E. E. Bylander, 3303 Tiley Drive N.E.

Supervisory Appointments



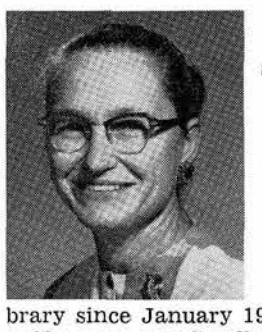
W. F. (LEE) STINNETT to supervisor of Maintenance Planning and Control Division 4517, Plant Maintenance Department, effective July 1.

Lee has been at Sandia 14 years and has worked in manufacturing development, manufacturing develpoment procedures, product data systems planning, and most recently in Value Engineering and Cost Improvement Division 2563.

Previously he was attending the University of Colorado where he received a BS degree in mechanical engineering and a BS degree in business science.

Lee served one year in the Air Force.

He is president of the New Mexico area chaper of the American Institute of Industrial Engineers, is a member of the National Society for Professional Engineers and the New Mexico Society for Professional Engineers, and is a registered professional engineer in New Mexico.



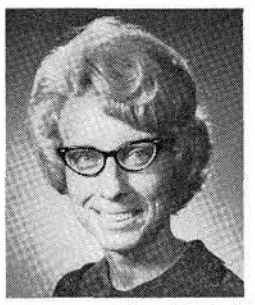
MRS. WILLIE SERVIS to supervisor of Book and Report Circulation Section 3421-3, Technical Libraries Division, effective June 16.

Willie has been at Sandia eight years and has been assigned to the library since January 1960.

She came to Sandia from the National Bureau of Standards in Boulder, Colo., where she was a supervisor in the technical library. Before that she helped establish a technical library for Rohn and Haas in Huntsville, Ala.

Willie has a BS degree in chemical engineering from Mississippi State College and attended the Librarianship School at the University of Washington. She is a member of the American Chemical Society and the Special Libraries Association.

From 1944-46 she served in the WAVES as an Aerographer's Mate.



MISS CALLA ANN CREPIN to supervisor of Book and Report Cataloging Section 3421-2, Technical Libraries Division, effective June 16.

Calla Ann came to Sandia in 1956 and was an employment interviewer for women at the time she terminated in 1962 to continue her education. Upon her return in 1963, she was assigned to the technical library.

She has a BA degree in biology from Lake Forest College (Ill.) and an MS in library science from Western Reserve College in Cleveland.

Calla Ann is a member of the Special Libraries Association and the New Mexico Library Association.

JOHN L. GARDNER to supervisor of Ordering and Periodical Distribution Section 3421-1, Technical Libraries Division, effective June 16.

John has been with Sandia's technical library since September 1964. Previously he was manager of the technical information center for General Precision Aerospace, Little Falls, N. J.; librarian in the sports branch of Time, Inc., in New York City; manager of the research library of Allen B. DuMont Labs, East Patterson, N. J.; and librarian and editor for the U.S. Salvage Association, New York City.

John is a graduate of the Birmingham (England) School of Librarianship, is a chartered librarian, and is an associate of The Library Association.

From 1946-48, he served in the Middle East with a Royal Air Force Regiment.

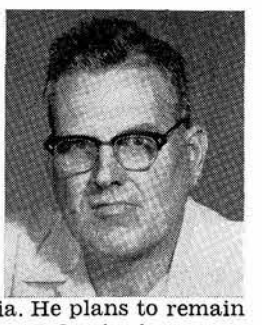
MRS. CROWELL DEAN to supervisor of Information Services Section 3421-4, Technical Libraries Division, effective June 16.

She has been with Sandia's technical library since 1959 and previously was head of the information center and library for A. E. Staley Manufacturing Company, Decatur, Ill., for two years. She spent a similar period with the technical library at Los Alamos Scientific Laboratory.

Before that, Crowell was a research chemist with California Research Corporation in Richmond.

She holds a BS degree in chemistry from the University of North Carolina and an MS degree in library science from the University of Denver. Crowell is a member of the American Chemical Society and the American Association for the Advancement of Science.

Retiring . . .



Burrell R. Snelling of Heavy Machine Section 4252-1, retired June 15—exactly 14 years from the day he joined Sandia.

Mr. Snelling, a skilled craftsman in metal spinning, operated his own shop in Ohio for 14 years prior to joining Sandia. He plans to remain active in the field of metal spinning as an officer with a local firm.

On the subject of special interests or any leisure time he might have, Mr. Snelling is specific. "The hobby I enjoy most is 'work,'" he comments. "I'm always busy, and my wife Emily enjoys the same activities and has been a great help to me." In 1956 he built their home at 614 Palomas Dr. NE in just six months of spare time. All the work was done by the family with the exception of some carpenter work which was sub-contracted.

"My current hobby," Mr. Snelling says, "is converting a 1960 Ford Vanette to a completely self-contained mobile home, which we will use for vacations and fishing trips." He hopes to have it completed by September when he and his wife will vacation in Canada. There they will meet their 21-year-old son Dean, who is completing a two-year missionary tour.

Their other son, Jay (5142), is married and lives in Albuquerque.

Sandia's Safety Scoreboard

Sandia Laboratory:

27 DAYS

945,000 MAN HOURS

WITHOUT A

DISABLING INJURY

Livermore Laboratory:

15 DAYS

83,000 MAN HOURS

WITHOUT A

DISABLING INJURY